Rediscovery of Discus brunsoni Berry,1955 and Oreohelix alpina (Elrod, 1901) in the Mission Mountains, Montana, With Comments on Oreohelix elrodi (Pilsbry, 1900)

Paul Hendricks

Montana Natural Heritage Program

1515 East Sixth Avenue

Helena, Montana 59620

and

909 Locust Street

Missoula, Montana 59802

(406) 543-0995

email: phendricks@nris.mt.gov

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ABSTRACT

During summer 1997, extant populations of the endemic land snails Discus brunsoni and Oreohelix alpina were rediscovered near the type localities in the Mission Mountains, Montana; last known collections were made 33 and 48 years ago, respectively. D. brunsoni and Oreohelix elrodi (also endemic to the Mission Mountains and nearby Swan Range) were previously reported to be sympatric in subalpine limestone talus. Both species were found in 1997 in diorite talus; the latter species also occupied argillite talus with little, if any, limestone present at any site. Live D. brunsoni (n = 8) were found near the talus surface only on bare rock or foliose lichen on rock during cool, wet conditions. Live O. elrodi were found near the talus surface on rock (n = 9) or organic litter accumulations (n = 55) during all conditions, although in reduced number during warmer and drier weather. Above treeline, live O. alpina were found exclusively in exposed locations under limestone talus, sometimes attached to rock surfaces (n = 7) but more often present in organic detritus (n = 10). Lack of collections of D. brunsoni and O. alpina in recent decades probably resulted from 1) extremely restricted distributions, 2) limited knowledge of habitat requirements, and 3) scarcity of active collectors in the region.

Key words: Discus brunsoni, Oreohelix alpina, Oreohelix elrodi, Montana, distribution, ecology.

INTRODUCTION

The Mission Mountains of northwestern Montana are recognized as an area of significant snail endemicity in the Interior Columbia River Basin (Frest and Johannes 1995). The mountains extend about 80 km north to south and 19 km east to west, rising abruptly from a base at 1036 m in the Swan and Flathead valleys to a crest of nearly 3018 m. The range is composed of Precambrian Belt rocks (mostly limestone and argillite) that were deeply dissected by alpine glaciers during the Pleistocene (Alden 1953). The Mission Mountains still support small cirque glaciers and permanent ice patches. The portion of the mountain range within Lake County contains the type localities for three narrowly endemic terrestrial snail species, none of which has yet been documented at more than two sites.

Oreohelix elrodi (Pilsbry, 1900) was discovered in 1899 in talus slopes between 1067-1524 m above the north side of McDonald Lake (Pilsbry 1900, Elrod 1903a), where it was most common, and also found rarely along the south side of the lake. The amphitheater around McDonald Lake remains the only known locality for this species in the Mission Mountains, but it has been found more recently above Lion Creek in the nearby Swan Range (Fairbanks 1984). Oreohelix alpina (Elrod, 1901) was first found in 1900 on ASinyaleamin Mountain≅ (Elrod 1901, 1902, 1903b) and again later that year on the west ridge of McDonald Peak; both localities were above treeline between 2377-2743 m and remain the only sites where this species has been located. Discus brunsoni Berry, 1955 was first encountered (a single shell) in 1948 in talus slopes above the north side of McDonald Lake at an estimated elevation of 1067 m, with additional material collected there in 1950 (Berry 1955, Brunson 1956). The type locality remains the only known site for D. brunsoni. Interestingly, this talus slope is also the type locality for O. elrodi,

which had been collected several times between 1899 and 1948 (Brunson 1956), but D. brunsoni was not discovered there until almost half a century later. Known localities for the three snail species in the Mission Mountains are within the Mission Mountains Tribal Wilderness of the Confederated Salish and Kootenai Tribes and are relatively secure from human disturbance. None of the snail species has any special federal designation but all three are on the state list of Animal Species of Special Concern maintained by the Montana Natural Heritage Program.

Live Oreohelix elrodi were reported at the type locality as recently as 1993 (Frest and Johannes 1995). There are no known collections in recent years, however, for O. alpina and Discus brunsoni (Frest and Johannes 1995). Apparently, O. alpina was last collected on 2 August 1949 on McDonald Peak, and D. brunsoni was last collected on 29 May 1964 at McDonald Lake (R. B. Brunson pers. comm. for both collections). Primary objectives of the study reported here were to 1) revisit the type localities of Oreohelix alpina and Discus brunsoni and, if possible, locate extant populations of each species, and 2) supplement previous brief descriptions of the habitats where each species is found.

STUDY SITES AND METHODS

I used a variety of sources to obtain relatively precise descriptions of type localities and habitat use by Oreohelix alpina and Discus brunsoni, including published literature and conversations with Dr. R. B. Brunson, who made the last known collections of each species. The type locality of D. brunsoni was easily identified. Berry (1955) provided a photograph of the site and Brunson (1956) added considerable detail of the conditions and physical setting where this species was discovered. The site (Site 1) is an extensive talus slope on the north side of McDonald Lake (T19N R19W S11) that is accessible by trail. Trips to Site 1 were made on 10

June, 1 July, 4 July and 10 July 1997. Rock at Site 1 was composed predominantly of blocks of diorite about 1 m^3 in size, with less than 5% argillite fragments intermixed. Neither rock material effervesced in acid, indicating the absence of calcium carbonate. Canopy cover was 0% in the search area, slope = 36^0 facing SSE. Forest at the margins of the talus slope was composed of Douglas-fir (Pseudotsuga menziesii) and ponderosa pine (Pinus ponderosa). Pockets of water birch (Betula occidentalis), quaking aspen (Populus tremuloides) and mock orange (Philadelphus lewisii) were scattered in and near the margins of the talus and comprised much of the organic litter among the talus fragments. Talus was inspected to a maximum depth of 1 m in an area of 25 X 40 m. Additional searches during other visits to Site 1 were focused in this area. Site 2 (about 100 m east of Site 1) was composed of about equal amounts of smaller-sized diorite and argillite; average talus fragment size was about 30 X 30 cm. Canopy cover (surrounding species composition as at Site 1) was 0%, slope = 32^0 facing SSE, search area was 15 X 20 m. Site 3 was about 500 m east of Site 2. Search area at Site 3 was 10 X 25 m, rock was 100% argillite with average fragment size about 10 X 20 cm. Slope, aspect, cover and surrounding vegetation at Site 3 were similar to the other two sites.

Access to the historical sites of Oreohelix alpina was not so straightforward. Neither location can be reached by trail. The McDonald Peak site is in the Grizzly Bear Conservation Zone of the Mission Mountains Tribal Wilderness and closed to all recreational use from 15 July-1 October. Snowpack often precludes trips into the alpine before mid-July, so the McDonald Peak site was not visited in 1997. Elrod (1901, 1902, 1903b), Pilsbry (1939) and Frest and Johannes (1995) describe the type locality as above treeline on ASinyaleamin Mountain.≅ There is no Sinyaleamin Mountain on current U.S.G.S. topographic maps. Details of the 1900 trip on

which the species was discovered (Elrod 1902) indicate, however, that Sinyaleamin Mountain is now known as East St. Marys Peak; O. alpina was collected by Elrod on the southwest ridge of that mountain (T18N R18W S20).

I climbed East St. Marys Peak on 27 August 1997 and searched for Oreohelix alpina at two sites (Sites 1 and 2) on the southeast ridge (T18N R18W S21) and also the top of the southwest ridge (Site 3), which included the summit. Site 1 was a broad level area atop the southeast ridge at approximately 2637 m; the ground was covered with a variety of alpine forbs and grasses (vegetation cover = 60-70%) in which were open patches of limestone scree (fragment diameter about 2-4 cm). Site 2 was farther north about 1 km, where the ridge narrowed between 2713-2774 m. Exposure at this site was to the southwest but near the ridge crest. Shallow limestone talus became predominant with only scattered patches of alpine vegetation present (cover = 85-95% rock). Plants in the area included snow cinquefoil (Potentilla nivea), mountain avens (Dryas octopetala), alpine sorrel (Oxyria digyna) and moss campion (Silene acaulis). Site 3 included the summit (2873 m) and top of the southwest ridge. Plant composition and percent cover at this site were similar to Site 2.

Time spent searching for each species was recorded as a measure of search effort (Ausden 1996); time of day refers to Mountain Daylight Time. The substrate on which each live snail was found (Arock≅ or Aorganic litter≅) was noted, and shell diameter of live individuals was measured with a dial caliper. Photographs of live snails and habitats for each species were taken and are available from the Montana Natural Heritage Program, Helena, Montana. G-tests (Sokal and Rohlf 1981) were used to analyze frequency distributions of substrate use; statistical significance was assumed when $P < 0.05$.

RESULTS

Discus brunsoni and Oreohelix elrodi

Presence at different sites: Three talus sites within the general type locality of both species were examined during four different visits (Table 1). All sites were at 1128 m along the trail paralleling McDonald Lake on its north side. On 10 June and 4 July, weather was sunny and warm (21-23^{0}C) at the time of the searches (10:15-12:00); no precipitation had fallen in the previous 48 hours. On both dates only Site 1 was checked. Four live estivating Oreohelix elrodi and no Discus brunsoni were found during 75 min of searching by two persons on 10 June. The 4 July visit was devoted to study of the rocks and no live snails of either species were noted.

On 1 July weather was wet and cool (10^{0}C) during the search period (10:00-13:00); the area received steady precipitation during the previous 48 h. At Site 1 I found 20 live Oreohelix elrodi and 5 live Discus brunsoni in 120 min. At Site 2 I found 11 O. elrodi and no D. brunsoni during 60 min. Under similar conditions on 10 July (wet, 14-17^{0}C) I found 19 live O. elrodi and 3 live D. brunsoni at Site 1 during 120 min (11:00-13:00). At Site 2 I found 7 live O. elrodi and no D. brunsoni in 30 min (13:30-14:00). At Site 3 I found 7 live O. elrodi and no D. brunsoni in 15 min (15:35-15:50).

Substrate selection within talus: Substrate of occurrence (rock, organic litter) for live snails found at all three sites was documented on 1 and 10 July. All (n = 8) live Discus brunsoni were found on bare or lichen-covered rock. Nine of 64 live Oreohelix elrodi were found on similar substrate, 55 were found on organic litter accumulations (bark, twigs, leaf fragments, needles) or live moss among the talus. The difference between the two species in frequency of substrate occurrence was statistically significant (G = 26.724, df = 1, $P < 0.001$).

Shell diameter: Discus brunsoni averaged 9.5 mm diameter and ranged from 6.7-10.5 mm (Table 1). For Oreohelix elrodi at Site 1, 28 (71.8%) of 39 live individuals were > 15 mm diameter. At Sites 2 and 3 the respective numbers of live snails in this category were 6 (33.3%) of 18, and 2 (28.6%) of 7. Samples undoubtedly contained members of more than one cohort. The presence of individuals $\leq$ 7.5 mm diameter in each sample suggests reproduction is occurring at each site.

Oreohelix alpina

Presence at different sites and substrate selection: Weather on East St. Marys Peak was clear and cool (12.5^{0}C at the summit) on 27 August. I found no snails in 30 min (12:15-12:45) at Site 1 on the southeast ridge.

At Site 2 I found 16 live O. alpina in 45 min (13:30-14:15) in three areas searched along 300 m of ridge. All live snails were under limestone blocks about 20 X 30 cm square and 4-8 cm thick. Six snails were attached to the undersides of limestone fragments or atop bare rock beneath overlying blocks, one group of 10 live snails was found in leaf litter (area = 9 cm^2) accumulated near the base of snow cinquefoil. Some soil development was present at each site where live snails were found. Dead shells were found with little effort on open ground.

I searched the summit area (Site 3) for 15 min (14:30-14:45) and found one live snail at 2865 m near the top of the southwest ridge. This individual was on bare rock under a limestone block near a patch of snow cinquefoil.

Shell diameter: Mean ($\pm$ SD) diameter of live shells (n = 16) was 5.7 $\pm$ 1.9 mm; range was 2.5-8.5 mm. The smaller individuals indicate reproduction is probably occurring at this location. Mean diameter of dead shells for which measurements were possible (n = 9) was 8.9 $\pm$ 0.5 mm; range was 8.0-9.6 mm.

DISCUSSION

Extant populations of Discus brunsoni and Oreohelix alpina were located in 1997 at or near the type localities 33 and 48 years, respectively, after the last documented collections (R. B. Brunson pers. comm., T. J. Frest pers. comm.). The range in shell size of live individuals at each site (including O. elrodi sites) indicates the presence of multiple cohorts and likelihood of continuing reproduction. The sites where O. alpina was found on the southeast ridge of East St. Marys Peak represent a slight range expansion at the type locality, where Elrod (1902) found them on the southwest ridge. I have found no evidence that O. alpina has been collected on East St. Marys Peak since 1900, when Elrod discovered the species. The last documented collection of O. alpina (Brunson specimen catalog) was made on McDonald Peak on 2 August 1949. Correspondence from Stillman Berry (21 August 1951: Brunson pers. comm.) indicates that another collection may have been made on McDonald Peak in 1950 or 1951, but there is no evidence of this in Brunson=s catalog.

Several interacting factors probably contributed to the failure to find Discus brunsoni and Oreohelix alpina during the last several decades. First, I know of no active resident collectors of terrestrial mollusks. Non-resident collectors passing through the area may have visited sites when conditions were not especially favorable for finding these species (D. brunsoni in particular) near the surface of talus slopes. The nearly half-century span between first discoveries of O. elrodi and D. brunsoni at the same site supports this contention. Differences in habitat selection may have contributed to this lapse, as will be discussed below. Furthermore, it seems unlikely that very many non-resident collectors would attempt to visit the relatively inaccessible localities of O. alpina. Second, the known distributions of both species are quite restricted. It would be easy to

overlook them without clear knowledge of the geographical area. For example, it is impossible to identify ASinyaleamin Mountain≅ or the exact location of O. alpina on this mountain or McDonald Peak without a copy of Elrod=s (1902) description of his collecting trip. Third, habitat requirements, especially for D. brunsoni, may be more narrow than previously appreciated. Information gleaned from Berry (1955) and Brunson (1956) suggests that D. brunsoni and O. elrodi are sympatric in talus slopes on the north side of McDonald Lake. However, it may be that both species co-occur in only a very restricted zone defined by the narrower habitat preference of D. brunsoni. Evidence to date indicates that O. elrodi is significantly more widespread, even in the McDonald Lake cirque.

All three snail species favor exposed talus habitats. The type of talus in which each species is found, however, appears to differ among species. Oreohelix alpina is found exclusively above treeline in shallow limestone talus on mountain ridges. The descriptions provided by Elrod (1901, 1902, 1903b) and Frest and Johannes (1995) agree generally to my findings in 1997. Elrod (1902) commented that the snails were found among and under rocks with little vegetation nearby. All live individuals I located were under the protection of stones in areas of scant vegetation cover, but usually with some soil and litter accumulation nearby. Ten (62.5%) of 16 live individuals that I could measure (one shell was broken during handling) were smaller than the minimum diameter (7 mm) described for this species (Elrod 1903b, Pilsbry 1939). However, size range of empty shells found mostly on open ground closely matched the published range and mean. Perhaps adults are more likely to be caught away from refuges in adverse conditions, and fatalities washed onto open ground.

Discus brunsoni and Oreohelix elrodi are found well-below treeline in talus slopes

surrounded by closed- and open-canopy forest (Brunson 1956), but the rock types comprising the talus inhabited by the snails are infrequently mentioned in published reports. Berry (1955) and Frest and Johannes (1995) identified the talus as limestone; both Elrod (1901, 1902, 1903a) and Brunson (1956) failed to mention rock composition. I did not detect limestone at the three sites where I found one or both species. D. brunsoni was found exclusively in talus predominantly of diorite boulders. O. elrodi was found at this site as well as in smaller-sized talus of argillite (Table 1). D. brunsoni may be more of a habitat specialist than previously appreciated, associating with only a subset of available rock types.

The biology and ecological requirements of Discus brunsoni and Oreohelix elrodi remain largely unknown, so explanations for patterns of presence or absence near the surface of talus slopes are speculative. O. elrodi was more abundant (4-6 fold during my searches) than D. brunsoni near the surface of talus in wet and cool conditions, and a few individuals could be still be found when it was warmer and drier. Several factors could contribute to this pattern. First, absolute population size of O. elrodi at Site 1 may be greater than that of D. brunsoni. Ratios of each species near the talus surface could be representative for all depths in talus. Second, I found significant differences between the two species in substrate use. Some D. brunsoni were found on foliose lichen (tentatively identified as Arctoparmelia subcentrifuga) growing on the diorite, but otherwise were on bare rock. In contrast, O. elrodi were most often found on organic litter and vegetation. Preference by O. elrodi for organic litter may keep them nearer the surface of talus slopes where litter accumulations are larger and apparently more numerous. Third, larger shell size of O. elrodi might reduce its rate of desiccation by decreasing the surface area/volume ratio (see Goodfriend 1986), allowing larger individuals to remain nearer the drier talus surface for

longer periods than D. brunsoni and small O. elrodi. The four live O. elrodi found on 10 June in warm and dry conditions were 18-21 mm diameter and estivating at that time. Fourth, D. brunsoni may tend to be nocturnal or crepuscular and make vertical migrations to the talus surface during periods of activity (Brunson 1956). Timing of my searches would not have detected this.

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Table 1. Maximum diameter (in mm: mean ± SD) of live Oreohelix elrodi and Discus brunsoni in three talus sites on 1 and 10 July 1997, Mission Mountains, Montana. Sample sizes are in parentheses.

	Site 1	Site 2	Site 3
Rock type	diorite	diorite, argillite	argillite
Average fragment size	1.0 m^3	0.09 m^3	0.02 m^3
O. elrodi			
mean	16.2 ± 4.5 (39)	14.0 ± 4.7 (18)	12.0 ± 4.2 (7)
range	4.1 - 22.6	7.5 - 22.3	6.5 - 17.7
D. brunsoni			
mean	9.5 ± 1.4 (8)	----	----
range	6.7 - 10.5	----	----